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(54) Cosmetic delivery system.

(57) Cosmetic agents such as perfumes, e.g. in the form of body sprays, are delivered to the body by means of electrostatic spraying.

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This invention relates to a system for delivering cosmetic agents to various parts of the body. More particularly, the invention relates to methods and apparatus for delivering cosmetic agents to for example the skin or other target areas of the body using the principle of electrostatic spraying.

Conventionally, cosmetic agents for application to various parts of the body are frequently delivered by means of spraying, particularly when the cosmetic agent is to be applied to a large or non-localised area of the body, such as the application of deodorant compositions to the skin. Such spraying regimes, frequently referred to simply as "aerosols", rely on a pressurised propellant-containing can or a manually operable pump-action spray device to generate a spray of the product to be delivered, which is generally a solution or mixture of the cosmetic active in one or more solvents, frequently with one or more other adjunct materials as conventionally used in personal product formulations.

These known aerosol delivery systems are inefficient and represent uneconomical use of cosmetic raw materials. They are often also bulky, heavy and expensive, and are noisy to use. A further problem associated with these known aerosol delivery systems is that they have generally limited sensory appeal, especially in that they generate cold, wet sprays. Furthermore, with these sprays there is only partial capture of product at an intended site and thus significant waste through loss of cosmetic active material and additional ingredients (if present) to the atmosphere which also results in unwanted atmospheric mists and contamination to the user's eyes or other body parts, which may present respiratory or other health problems to the user.

When propellants are employed to generate an aerosol spray, these are frequently volatile organic compounds, which are now well recognised as being environmentally unfriendly, possibly hazardous to health and indeed are being legislated against in many countries of the world.

Conventional sprays also suffer from the inability to provide 100% coverage of a given target, e.g. all areas of the surface of hair fibres, all areas of the surface of the skin (which is not flat and presents a very rough terrain on a microscopic scale), or areas of the body surface which are ordinarily, or as a result of some disability, difficult to reach.

In a very different technical field, the principle of electrostatic spraying of liquid and solid materials is also known. In this technique a formulation to be sprayed is raised to a high electric potential in a spray nozzle to cause the formulation to atomise as a spray of electrically charged droplets. Such electrically charged droplets seek the closest earthed object to discharge their electric charge, and this can be arranged to be the desired spray target. Hitherto, electrostatic spraying techniques have been proposed principally for only large-scale industrial and agricultural applications, especially for delivering reactive materials like paints, adhesives and other surface coatings, as well as large-scale delivery of pesticides and other agricultural or agrochemical formulations. Examples of disclosures in this field include GB-A-1393333, GB-A-1569707, GB-A-2092025, EP-A-029301, EP-A-253539 and WO-A-85/00761, the contents of which disclosures are incorporated herein by reference.

More recently, there have been a small number of proposals for utilising the known principle of electrostatic spraying for delivering particular materials in specific applications other than those mentioned above.

EP-A-224352 suggests the use of an electrostatic sprayer for delivering a pharmaceutically active agent to the eye, to replace conventional ocular treatment using eye drops.

JP-A-56-97214 (dating from 1981) suggests the use of electrostatic spraying for applying a granular (i.e. solid particles of) colouring material to hair to effect surface coating thereof. The use of hair spraying agents instead of colouring substances is mentioned, apparently speculatively, but the disclosed system is unsuitable as far as consumer applicability and appeal is concerned and still suffers from some of the disadvantages mentioned above, particularly atmospheric contamination and non-localised application.

Also to be mentioned, though of less relevance, is US 4776515, which proposes an electrodynamic fine particle negative ion generator adapted to spray various liquids, particularly water, but possibly also alcohol, perfume, ammonia, liquid medications and surfactants. The object of the disclosed system is to provide an ozone-free mist of negatively ionised liquid particles, (which presupposes that the material to be sprayed is ionizable), and the mist that is produced instantly disperses into an open area in which the apparatus is operated, e.g. a room, so that a far-reaching, uniform aerosol is generated which has particular applicability for large public areas such as .hospitals, restaurants and offices. Clearly, this system is unsuitable for small-scale personal use and in many of its objects goes directly against the principles upon which a solution to the above mentioned prior art problems must be founded.

As a result of identifying and appreciating the above problems, prejudices and limitations of the known art and through much experimentation, we have now devised a system which enables the principle of electrostatic spraying to be put to effective use in delivering cosmetic agents to various parts of the body, such that apparatus and methods are now provided for such delivery regimes which are technically efficient, cost effective, safe, have widespread consumer applicability and appeal, and which solve or at least ameliorate many, if not all, of the problems associated with the prior art.

Accordingly, in a first aspect the present invention provides a method of delivering a cosmetic agent to the body, comprising electrostatically spraying said cosmetic agent thereon.

In more detail, the method of this aspect of the invention preferably comprises:

(a) providing an apparatus which includes:

(i) a reservoir containing the cosmetic agent to be delivered which is in an electrostatically sprayable form;

(ii) at least one delivery means in communication with the reservoir;

(iii) a high voltage generator powered from an electricity source;

(iv) control means for selectively applying the high voltage from the generator to the or each delivery means; and

(b) actuating the said control means to electrostatically spray the cosmetic agent from the or each delivery means onto the body at an intended site.

In a second aspect, the present invention provides an apparatus for delivering a cosmetic agent to the body, comprising:

(a) a reservoir for containing the cosmetic agent which is in an electrostatically sprayable form;

(b) at least one delivery means in communication with the reservoir;

(c) a high voltage generator powered from an electricity source;

(d) control means for selectively applying the high voltage from the generator to the or each delivery means to electrostatically spray the cosmetic agent from the or each delivery means.

In a third aspect, the present invention provides, in combination, the apparatus as defined above and an electrostatically sprayable composition consisting of or containing a cosmetic agent to be delivered to the body.

In the above defined aspects of the invention, the cosmetic agent to be delivered may be any cosmetic agent conventionally applied by known aerosol spray regimes, but is preferably an agent which is normally applied to the body to impart one or more desirable sensory benefits, preferably those benefits associated with smell, touch or feeling.

As used herein, the term "body" is intended to exclude the hair and encompass only those areas of the body upon which cosmetic agents are used to provide one or more sensory benefits which are perceived by smell or touch or feeling.

Particularly surprisingly, the novel delivery systems in accordance with this invention, as well as providing a significantly more capture efficient spraying technique, have also been found to give unusual and unexpected sensory results upon delivery of a variety of cosmetic actives to the body, especially the back, legs and arms. The 360° wrap-around, high product capture, silent, invisible and non-wet spray characteristics are among those features which present themselves as particularly novel and beneficial in this context.

Having thus defined the main aspects of the present invention, preferred embodiments and various optional features and characteristics thereof will now be described, with reference to the accompanying drawings, in which:

Figure 1 is a schematic median view of one preferred embodiment of the apparatus according to the present invention;

Figure 2 is a schematic median view of an alternative embodiment of the apparatus;

Figure 3 illustrates the variation in resistivity with composition of solutions of perfume in ethanol;

Figures 4(a)-(e) illustrate spray width characteristics of various perfume + ethanol solutions delivered using the preferred apparatus in accordance with the invention; and

Figures 5(a)-(e) illustrate spray quality characteristics of various perfume + ethanol solutions delivered using a preferred apparatus in accordance with the invention.

Cosmetic agents which may be delivered using the system of the present invention may be any of a wide range of materials used to impart one or more sensory benefits to a region of the body, such as the skin, to which they are applied. Preferred cosmetic actives, which may be used either singly or in combination, are those which impart a deodorant, antibacterial, freshening, moisturising or conditioning benefit, examples of which agents are well known in the art. Examples of suitable cosmetic actives of the above types include the following:

1. Deodorants - perfumes, essential oils;

2. Antibacterials - Triclosan (2,4,4'-trichloro-2'-hydroxy-diphenyl ether), chlorhexidine acetate (1,6-di-(N-p-chlorophenyldiguanido hexane acetate);

3. Fresheners - Ethanol, volatile hydrocarbons, volatile silicones, menthol;

4. Moisturisers - Glycerol, isoprene glycol, 2-pyrrolidone -5-carboxylic acid, 2-hydroxyalkanoic acids and acid-soap complexes thereof;

5. Conditioners - Silicone oils, silicone copolyols, olive and other plant oils.

Particularly useful materials to which the invention can be applied are deodorant materials, such as those found in conventional body sprays which contain as a principal active agent one or more perfumes.

A particular advantage of the present invention is that it allows at least some of, or even substantially all of, the adjunct components as conventionally used in body sprays and other cosmetic spray products to be omitted, thereby giving rise to a simpler and cheaper delivery system, with less waste. (This, however, will generally not apply to solvents, diluents or carriers, which are preferably still present, as discussed further below.) Any such adjunct components may however still be used within the scope of this invention if desired or as necessary.

Within the aforementioned guidelines, it is preferred that the cosmetic agent to be delivered in accordance with the invention is in the form of a composition containing one or more solvents, diluents or carriers for the cosmetic agent, with or without minor amounts of one or more adjunct materials as are known in the art or as will be described further hereinbelow. Suitable solvents, diluents or carriers are those which are soluble in or solubilise or are miscible with the cosmetic active(s) to be delivered. Examples of suitable solvents or diluents include for example alcohols or polyols such as ethanol, isopropyl alcohol, propylene glycol, dipropylene glycol, phenylethyl alcohol, glycerol, 1,3-butane diol, 1,2-propane diol, isoprene glycol.

In the above described compositions for delivery in accordance with the invention, the concentration of cosmetic active(s) may vary widely and may be selected for example in accordance with the type of material being delivered, other spraying parameters of the system and/or the needs or wishes of a user. Suitable concentrations of active may be in the range of from about 0.01% by weight to about 99% by weight of the composition, more preferably from about 0.1% to about 80% by weight. By way of illustration, cosmetic actives of the types exemplified above may be used effectively in concentrations represented by the following exemplary amounts:

- Deodorants:perfumes 0.01-10 wt%
- Antibacterials: 0.1-2 wt%
- Fresheners:
  Menthol 0.1-2 wt%
  Volatile oils 10-75 wt%, more preferably 10-25 wt%
  Ethanol 1-99 wt%
- Moisturisers: 0.1-30 wt%
- Conditioners: 1-75 wt%, more preferably 5-25 wt%.

Compositions to be delivered using the present invention are preferably liquids. Apart from any solvent or diluent which is present in combination with the cosmetic agent, any adjunct materials which are also included are preferably also liquid at room temperature, though may optionally be solids if used in minor amounts and do not deprive the composition of being electrostatically sprayable.

In the present invention combinations of one or more active cosmetic agents may be delivered simultaneously, either from the same composition sprayed from a single delivery means of the apparatus, or by delivering different cosmetic agents simultaneously from different delivery means.

Generally there is the essential overall requirement of compositions useful in the present invention that they be electrostatically sprayable.

A principal characteristic of such electrostatically sprayable compositions which it will usually be necessary to carefully select or adjust as necessary (as discussed further below), is their resistivity. Preferred resistivities fall within the range from about 10^4 to about 10^{12} ohm cm, more preferably from about 10^6 to about 10^{10} ohm cm. Resistivities of lower than 10^4 may possibly be used. Resistivities of more than about 10^{12}, e.g. up to about 10^{14} or more, may also be used, though such values are difficult to measure using cheap, conventional resistance measuring apparatus. Resistivity is measured using standard, conventional apparatus and methods, generally at 25°C.

Preferably compositions for delivery using the present invention are substantially non-aqueous or may contain only a small amount of water, e.g. less than 10% by weight, preferably less than 5% by weight, even more preferably less than 1% by weight. This is because, due to its low resistivity, a predominantly aqueous composition is generally difficult to spray effectively using electrostatic means.

As mentioned above, depending upon the composition or cosmetic material to be delivered, it may be necessary to adjust its resistivity by addition of one or more resistivity adjusting materials, examples and suitable amounts of which will be either known to persons skilled in the art or readily derivable by simple experiment. Suitably, polar substances such as alcohols, e.g. ethanol, may be used to lower the resistivity of a given cosmetic agent or composition containing same, whereas non-polar substances, e.g. oils and other hydrophobic materials, may be used to increase resistivity. Further examples of suitable resistivity adjusting agents include charged species such as salts, e.g. sodium chloride, or a salt conventionally used in buffers in personal products or pharmacological formulations. Generally, any resistivity adjusting agent that is used preferably solubilises or is soluble in, or is miscible with, the cosmetic agent or composition containing same.

In the context of the present invention and in particular the context of a body spray containing a solution

of a perfume in an alcohol such as ethanol, we have found that the variation in resistivity with concentration of the perfume is unusual and gives rise to a surprising resistivity profile. This is illustrated in Figure 3 of the accompanying drawings, which shows the resistivity profile of varying compositions of solutions of perfume (HD0220, ex Quest International) in ethanol.

Surprisingly, the addition of a perfume with a resistivity higher than that of ethanol reduces the resistivity of the mixture and this behaviour exists over a relatively wide range of compositions. In particular, it is surprising that admixtures of perfume and ethanol have resistivities which are less than the resistivities of either the perfume or ethanol alone. This unexpected behaviour has important consequences for the optimisation of a given spraying system and may dictate at least to some extent the choice of other spraying parameters as will be described further below. For instance, these resistivity data, like similar data for other combinations of materials, may be used to predict electrostatic sprayability or spray characteristics on the basis of resistivity, taking into account a given concentration of cosmetic active material and the variability and/or limitations on values of other parameters of the system such as flow rate or voltage.

In addition to resistivity, another parameter of the compositions to be sprayed which it may be necessary to carefully select and adjust is viscosity.

Compositions of a wide range of viscosities may be suitable for use in the present invention, but suitably the viscosity is in the range of from about 0.1 to about 50000 mPas, more preferably from about 0.1 to about 10000 mPas, even more preferably from about 0.5 to about 5000 mPas (at 25°C). If desired or as necessary one or more viscosity adjusting agents may be included. Examples of such agents include salts, e.g. alkali metal or ammonium halides, polymers and conventional thickening materials and oils and polar oil thickeners such as cosmetic oils, waxes, glycerides and suitable amphiphiles with melting points of for example >20°C.

For use in the present invention, the hardware and electrical componentry and circuitry may be of any suitable construction and design. The art of electrostatic spraying contains many examples of suitable apparatus which may be used in the present invention and such disclosures of such apparatus or particular features thereof may be applied either singly or in combination to the spray systems of the present invention.

Examples of suitable electrostatic spraying hardware include, in addition to those of the prior art references mentioned above, those of the following published references: GB-A-2061769, GB-A-2073052, EP-A-031649, EP-A-132062, EP-A-163390, EP-A-171184, EP-A-234842, EP-A-243031, EP-A-368494, EP-A-441501, EP-A-468735 and EP-A-468736; the disclosures of all of which are incorporated herein by reference.

As will be appreciated by persons skilled in the art, particular constructional features and design and electrical and other operating parameters of such apparatuses may be selected or adjusted as necessary, in the context of the present invention, in accordance with the desired functioning characteristics, as for example dictated by the composition or material to be sprayed and/or the needs or wishes of a user.

Features of the apparatus of the present invention which may be so selected and/or adjusted include for example: voltage generated by the high voltage generator and power source, electric field strength in or in the region of the product delivery means, flow rate of the product to be sprayed from the reservoir to and out of the delivery means, size and configuration of the delivery means itself and construction and properties of any product feed mechanism utilised between the reservoir and the output of the delivery means.

In preferred embodiments of the invention, preferred voltages generated by the high voltage generator from the power source are in the range of from about 5 to about 20 kilovolts, more preferably from about 12 to about 18 kilovolts. Voltages of more than 20 kilovolts, e.g. up to about 24 kilovolts or more, may be used if desired, for instance for products to be sprayed having particularly low resistivities, e.g. less than about 10^6 ohm cm and/or particularly high flow rates, e.g. >5 mls/min. The most suitable voltage for a given system may depend upon the product to be sprayed, as well as other parameters, all of which will generally be selected to give an overall optimised system. As a general rule, however, with preferred embodiments of the apparatus according to the present invention (as described further below), we have found that for a given flow rate of product being delivered, higher voltages are required to maintain fine sprays having high width when liquid products having relatively low resistivity, e.g. less than about 10^6 ohm cm, are used. This is illustrated in Figures 4(a) to (e) of the accompanying drawings.

Electric field strengths which are responsible for the spraying action of the electrostatic apparatus will be largely dependent upon the voltage applied. However, field strengths may be controlled or adjusted if necessary, for example by changes in nozzle configuration or geometry and/or the use of field intensifying electrodes, which are well known in the art cited above.

Optimum flow rates of material to be sprayed may often depend upon the composition of the product to be delivered, e.g. upon the concentration of the "active" cosmetic ingredient being applied. Also, as already mentioned with respect to viscosity of the sprayable material, a suitable flow rate may be selected depending upon the particular delivery regime and/or habit or needs of a user. By way of example, preferred flow rates of compositions for delivery in accordance with embodiments of the invention are in the range of from about

0.001 to about 10 ml/min, more preferably from about 0.1 to about 5 ml/min, even more preferably from about 1 to about 3 ml/min, per delivery means. With preferred embodiments of the apparatus of the present invention (as described further below), we have found that the latter range of flow rates, i.e. in the region of 1 to 3 ml/min, are most preferred for obtaining a fine spray with high width, which is generally sensorily superior to an equivalent spray which is coarser and narrower. This is illustrated in Figures 5(a) to (e) of the accompanying drawings.

The size and configuration of the one or more delivery means in the apparatus of the invention may be of any suitable form and again may be selected in association with other parameters to give an optimised functioning electrostatic spray delivery system. Commonly the or each delivery means will be in the form of a nozzle, preferably of insulating or semi-insulating material such as plastics or various polymers, as is well known in the art.

In a preferred form of nozzle, a conduit for carrying the product to be sprayed terminates in an orifice at the tip of the nozzle, from which orifice the product is ejected for example initially as a ligament but in any event eventually dispersing as a spray of charged droplets. The orifice preferably has a diameter of not greater than about 400 microns, more preferably not greater than about 350 microns. Even more preferably the orifice has a diameter of between about 125 and about 250 microns.

The delivery means may advantageously include metering means to provide a dosing mechanism for delivering a predetermined fixed amount of material from the or each nozzle. Such an expedient may for example be useful in conjunction with a system having a controlled flow rate.

In preferred embodiments of the apparatus of the invention, the or each delivery means is in communication, i.e. preferably fluid communication, with the reservoir or reservoirs (if for example more than one cosmetic agent or composition is to be desired to be sprayed from the same apparatus or even the same delivery means) by virtue of product feed means. Such feed means preferably comprises a hollow conduit through which the material or composition passes for example under the effect of capillary action. In systems which require a particularly high flow rate, alternative or additional feed means may be provided, for example a pump. This may be of any suitable type, e.g. electrically operated, but more conveniently it may be a simple mechanical device which exerts pressure on the reservoir(s) containing the material(s) or composition(s) to be sprayed, such that the contents thereof are forced out and to the delivery means. Alternatively, the feed means may comprise a wick, e.g. a porous wick, through and/or over which the product to be sprayed flows before reaching the point of high electric field strength where it is dispersed as a charged spray of droplets or particles.

As is well known in the art, the apparatus according to the invention preferably include a trigger (i.e. a manual control means) or alternatively an automatic control means to selectively apply the high voltage from the generator to the or each delivery means to electrostatically spray the cosmetic agent or composition onto the body at an intended site. Any other suitable control means however, e.g. which automatically control actuation of the system, may be used, as will be appreciated by persons skilled in the art.

There now follows a detailed description of two preferred embodiments of the apparatus of the present invention, in conjunction with which reference should be had to the accompanying Figures 1 and 2.

In a first preferred embodiment as shown schematically in Figure 1, the spraying apparatus is constructed with a similar size, shape and weight to a conventional aerosol spray, so as to form a hand-held unit which is easy to manipulate and use and suitable for personal use. The apparatus comprises an elongate housing 1, which is preferably electrically insulating, e.g. of a plastics material, within which the electrical and other hardware components of the apparatus are mounted.

Towards the base of the apparatus is housed a battery 8, such as a conventional low voltage, e.g. 1.5 to 12, particularly 9, volts, cell, which location allows ready access to the battery for the purpose of replacement when necessary. Indicated by numeral 6 is the high voltage generator, which converts the low voltage from the battery 8 into the high voltage of for example between about 12 and 18 kilovolts, which is required for raising the product to be sprayed to the high electric potential necessary to effect electrostatic spraying thereof. Suitable components of the high voltage generator 6 are well known in the art and comprise principally a coil or transformer to perform the voltage step-up function. If desired or as necessary, various packing elements of electrically insulating material, such as that shown as 7 in Figure 1, may be provided in order to increase the safety aspect of the high voltage apparatus and to reduce unwanted leakage paths to earth when the apparatus is in use.

Connected between the battery 8 and high voltage generator 6, as well as between the high voltage generator 6 and the remaining electrical components of the apparatus, are one or more circuit boards 12 containing any necessary auxiliary electrical componentry for ensuring effective and satisfactory functioning of the apparatus. Such additional circuit board(s) 12 may comprise for example DC/AC (or vice versa) converters, as well as voltage adjustment means to control the high voltage applied to the product delivery means from which the product to be sprayed is to be delivered.

In the upper region of the apparatus is mounted reservoir 2 which in this preferred embodiment is a bag-in-can type reservoir, as known per se in the art of personal products and spraying apparatus. The bag-in-can reservoir 2 constitutes a low pressure product feed mechanism whereby product to be sprayed is fed to the nozzle 14 of the apparatus ready for medium to high flow rate spray delivery. The product contained in the reservoir 2 which is to be sprayed may, as already described, be any of a wide range of materials, but is preferably a composition consisting of or containing one or more cosmetic agents which when applied to the body provide one or more sensory benefits associated with smell, touch or feeling. In one preferred embodiment, the product to be sprayed is similar in nature to a conventional body spray, namely a solution of a perfume in a suitable solvent, e.g. an alcohol such as ethanol.

In fluid communication, via a conduit 16, with the reservoir 2 is a nozzle 14, which is connected electrically to the high voltage electrics of the apparatus so that the product within the nozzle is raised to the high electric potential necessary to effect its egress from the nozzle under electrostatic forces and thus the electrostatic spraying thereof. The nozzle 14 comprises an internal chamber 17 which terminates at the tip of the nozzle in an orifice 18 from which the product within the chamber 17 emerges under the influence of the electrostatic forces. As already described, the orifice 18 most suitably has a diameter of between about 125 and about 250 microns and the flow rate of product emerging therefrom is most preferably in the range of about 1 to 3 ml/min. For these flow rates, it will generally be necessary to employ product feed means such as a pump (not shown in the Figure) to transfer product from the reservoir 2 to the nozzle 14 at the required rate. Typically a positive pressure of from about 1 to 4 psi will be suitable for this purpose.

The configuration of the nozzle 14 in the region of the orifice 18 may vary and may be selected in association with other spraying parameters in order to give an optimised system for a given product to be delivered. For example, the nozzle tip configuration as shown in Figure 1 may be particularly suitable for relatively high resistivity liquids to be sprayed, e.g. more than about 10^7 ohm cm, this configuration generating quite satisfactory fine, wide sprays of such products.

The apparatus is preferably provided with some kind of cap 30 for protecting the nozzle 14 and other delicate components in the upper region of the apparatus from physical damage or contamination when the apparatus is not in use.

Shown schematically in Figure 1 as 11 is a manual trigger which constitutes control means for selectively energising the unit to apply the high voltage to the nozzle to electrostatically spray the product therefrom. The trigger 11, like the other elements of the apparatus subject to unwanted voltage leakage or shock risk, is preferably constructed and situated to minimise such problems, expedients for which are known in the art.

Referring now to Figure 2 which shows schematically a magnified embodiment of the apparatus of the invention, the main form and construction of the apparatus is much the same as described above, except that here the position and configuration of certain components has been modified.

As illustrated schematically in the Figure, the reservoir 2' containing the product to be sprayed is now constructed as a positive pressure product feed device incorporating a diaphragm pump, the latter being well known in the art of pumps. The reservoir 2' therefore delivers a constant supply of product to the delivery nozzle 14' ready for delivery therefrom at medium to high flow rate. As shown in the Figure, metering means 17 may be provided between the reservoir 2' and the nozzle 14' for ensuring delivery of a fixed amount of product for a given instance or period of operation of the apparatus.

In the alternative apparatus embodiment shown in Figure 2, the electrical hardware components are preferably housed within a lower portion 20 of the apparatus, which may for example form a separatable module adapted for ready substitution with for example different upper portions of the apparatus having reservoirs containing different products capable of delivery.

In the illustrated modified configuration of nozzle 14', product is now directed horizontally therefrom, in a similar manner to a conventional aerosol spray, with the trigger control means 11' being at the top of the apparatus, so that charge leakage is reduced, as is the propensity of sprayed product to revert to the user's hand operating the trigger as the nearest earth target. This behaviour is particularly unwanted and so it is generally important to increase as far as possible the distance between the orifice 18,18' of the nozzle 14,14' and the user's fingers when the apparatus is held in the hand during use.

Figure 2 also shows schematically an alternative configuration of the nozzle 14' in the region of the orifice 18', which particular configuration has been found to be useful for effecting fine, wide sprays of products having relatively low resistivity, e.g. less than 10^7 ohm cm.

In order to demonstrate the advantages of the cosmetic delivery system in accordance with the present invention compared with a conventional aerosol spraying regime, some comparative experiments were conducted, as described in the following Examples.

Example 1

A conventional "IMPULSE" aerosol perfume body spray was compared with delivery of an equivalent composition using a preferred apparatus in accordance with the present invention. The apparatus used corresponded in its principal features to that shown in and discussed above in relation to Figure 1 of the drawings, but additionally including means for varying various operating parameters thereof, such as flow rate, voltage. The spraying voltage used was 16 kilovolts and the product flow rate was 1.5 gms/min. The product sprayed was a 1% by weight solution in ethanol of the same perfume used in the IMPULSE body spray of the prior art.

The two delivery regimes were subjected to a paired comparison test using 15 panellists who scored each regime for each of seven attributes, as shown in the results tabled below. Each spray was applied to the skin in a spray lasting two seconds.

The results are shown in Table 1 below.

Table 1

Mean scores for attributes

	Electrostatic spray (in accordance with the present invention)	IMPULSE Spray (in accordance with the prior art)
Noise during application	2	76
Force during application	7	79
Mistiness during application	17	75
Coldness during application	45	88
Coolness during application	62	84
Freshness after application	60	71
Perfume intensity after application	45	63

The electrostatic delivery system in accordance with the present invention was therefore perceived to be significantly quieter, less forceful and less misty than the conventional aerosol delivery system. The reduction in coldness and coolness during application whilst maintaining freshness and perfume intensity after application also indicate positive benefits of the invention compared with the prior art. As a further benefit, since the electrostatic spraying system dosed about 1/20 of that delivered with the conventional aerosol in the same delivery regime, the system in accordance with the invention furthermore gave more efficient perfume utilisation.

Example 2

Example 1 was repeated, but this time the electrostatic spraying apparatus of the invention utilised a flow rate of 3.0 gms/min and a voltage of 18 kilovolts. An equivalent paired comparison test for the same attributes was carried out with 18 panellists and the results are shown in Table 2 below.

Table 2

Mean scores for attributes

	Electrostatic spray (in accordance with the present invention)	IMPULSE Spray (in accordance with the prior art)
Noise during application	4	79
Force during application	19	80
Mistiness during application	23	63
Coldness during application	59	79
Coolness during application	70	81
Freshness after application	71	80
Perfume intensity after application	60	76

The above results show that similar superior sensory benefits are still perceived at the relatively higher flow rate (with coarser droplet size) and that perfume perception is relatively close given that the dosage in the electrostatic spraying regime was 1/10 that of the conventional aerosol.

Claims

1. A method of delivering a cosmetic agent to the body, comprising electrostatically spraying said cosmetic agent thereon.

2. A method according to claim 1, which comprises:
   (a) providing an apparatus which includes:
      (i) a reservoir containing the cosmetic agent to be delivered which is in an electrostatically sprayable form;
      (ii) at least one delivery means in communication with the reservoir;
      (iii) a high voltage generator powered from an electricity source;
      (iv) control means for selectively applying the high voltage from the generator to the or each delivery means; and
   (b) actuating the said control means to electrostatically spray the cosmetic agent from the or each delivery means onto the body at an intended site.

3. A method according to claim 1 or claim 2 wherein the cosmetic agent to be delivered is in the form of a composition comprising one or more solvents or diluents.

4. A method according to claim 3, wherein the composition has a resistivity of between 10^4 and 10^{12} ohm cm.

5. A method according to any one of claims 1 to 4, wherein the cosmetic agent is selected from the following: deodorants, antibacterial agents, fresheners, moisturisers, conditioners and mixtures thereof.

6. A method according to any preceding claim, wherein the high voltage generated by the high voltage generator is in the range 5 to 20 kilovolts.

7. A method according to claim 6, wherein the voltage is in the range 12 to 18 kilovolts.

8. A method according to any preceding claim, wherein the cosmetic agent is in the form of a composition which is sprayed at a flow rate in the range 0.001 to 10 ml/min.

9. A method according to claim 8, wherein the flow rate is in the range 1 to 3 ml/min.

10. An apparatus for delivering a cosmetic agent to the body, comprising:
(a) a reservoir for containing the cosmetic agent which is in an electrostatically sprayable form;
(b) at least one delivery means in communication with the reservoir;
(c) a high voltage generator powered from an electricity source;
(d) control means for selectively applying the high voltage from the generator to the or each delivery means to electrostatically spray the cosmetic agent from the or each delivery means.

11. An apparatus according to claim 10, further comprising product feed means between the reservoir and the or each delivery means for transferring cosmetic agent to be sprayed from the reservoir to the or each delivery means.

12. An apparatus according to claim 11, wherein the product feed means comprises a conduit optionally in combination with a pump.

13. An apparatus according to any one of claims 10 to 12, wherein the or each delivery means comprises a nozzle having an orifice from which the cosmetic agent is to be electrostatically sprayed.

14. An apparatus according to claim 13, wherein said orifice has a diameter of not greater than about 400 microns.

15. An apparatus for delivering a cosmetic agent to the body, comprising:
(a) a housing;
(b) a reservoir within the housing for containing the cosmetic agent which is in an electrostatically sprayable form;
(c) at least one nozzle having a spraying orifice and in fluid communication with the reservoir via a conduit optionally in combination with a pump;
(d) a high voltage generator within said housing and powered from an electricity source also therein; and
(e) control means for selectively applying the high voltage from the generator to the or each nozzle to electrostatically spray the cosmetic agent from the or each orifice thereof.

16. In combination, the apparatus according to any one of claims 10 to 15, and an electrostatically sprayable composition consisting of or containing a cosmetic agent to be delivered to the body.

17. An electrostatically sprayable composition consisting of or containing a cosmetic agent to be delivered to the body.

18. A composition according to claim 17, wherein the cosmetic agent is selected from the following: deodorants, antibacterial agents, fresheners, moisturisers, conditioners and mixtures thereof.

19. A composition according to claim 17 or claim 18, wherein the composition comprises one or more solvents or diluents for the cosmetic agent, optionally with one or more conventional adjunct materials found in personal product formulations.

20. A composition according to any one of claims 17 to 19, which has a resistivity in the range 10^4 to 10^{12} ohm cm.

21. A composition according to any one of claims 17 to 20, further comprising a resistivity adjusting agent and/or a viscosity adjusting agent.

22. A composition according to any one of claims 17 to 21 which is substantially non-aqueous or contains only less than 10% water.

23. Use of electrostatic spraying to deliver a cosmetic agent to the body.

24. Use according to claim 23, which employs the apparatus of any one of claims 10 to 14.

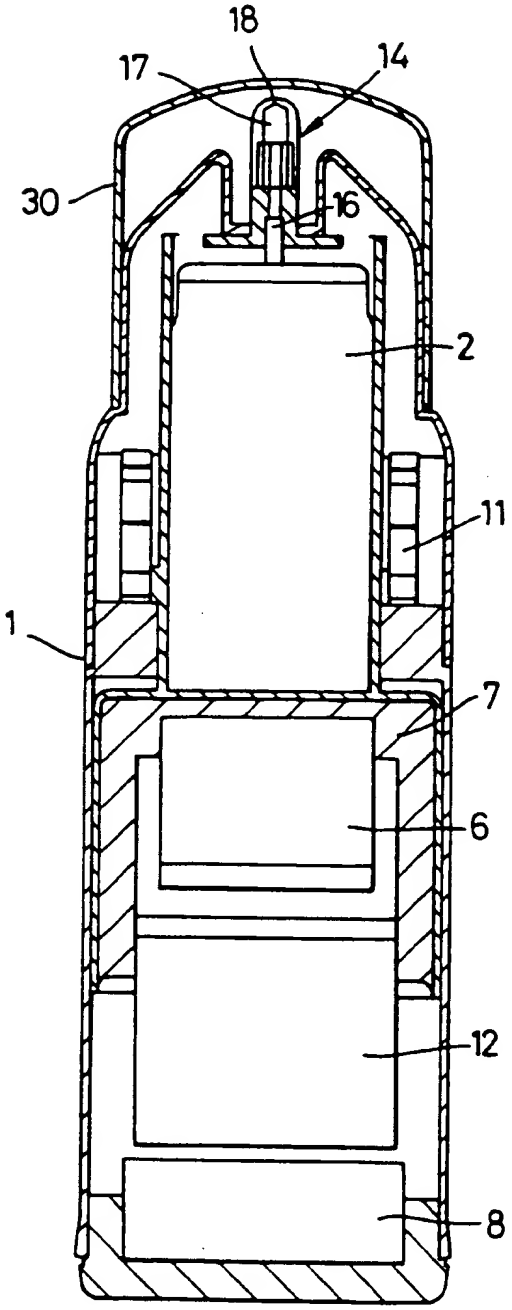


Fig. 1

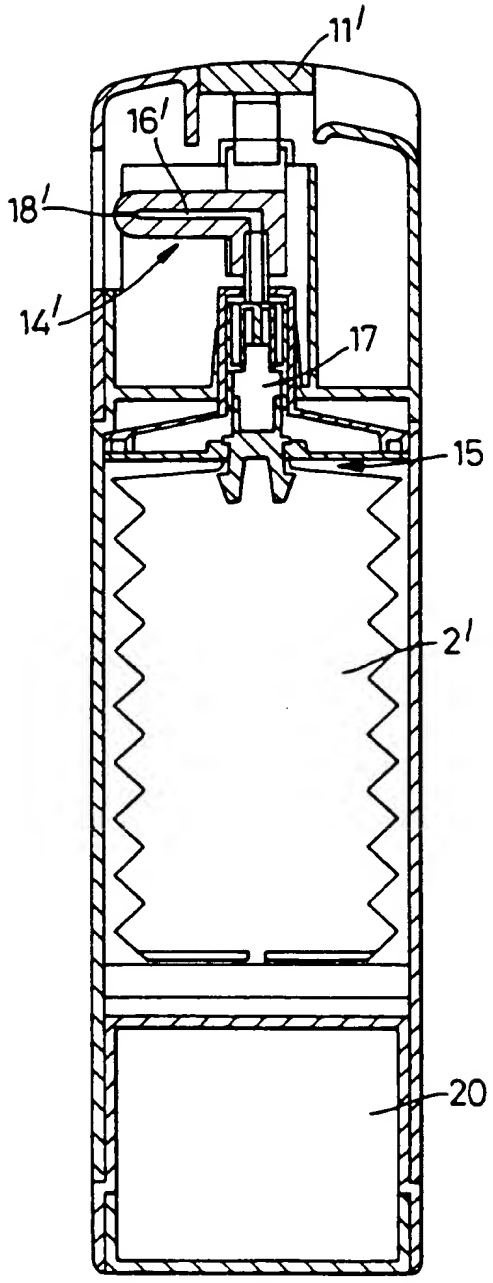


Fig. 2

Fig. 3

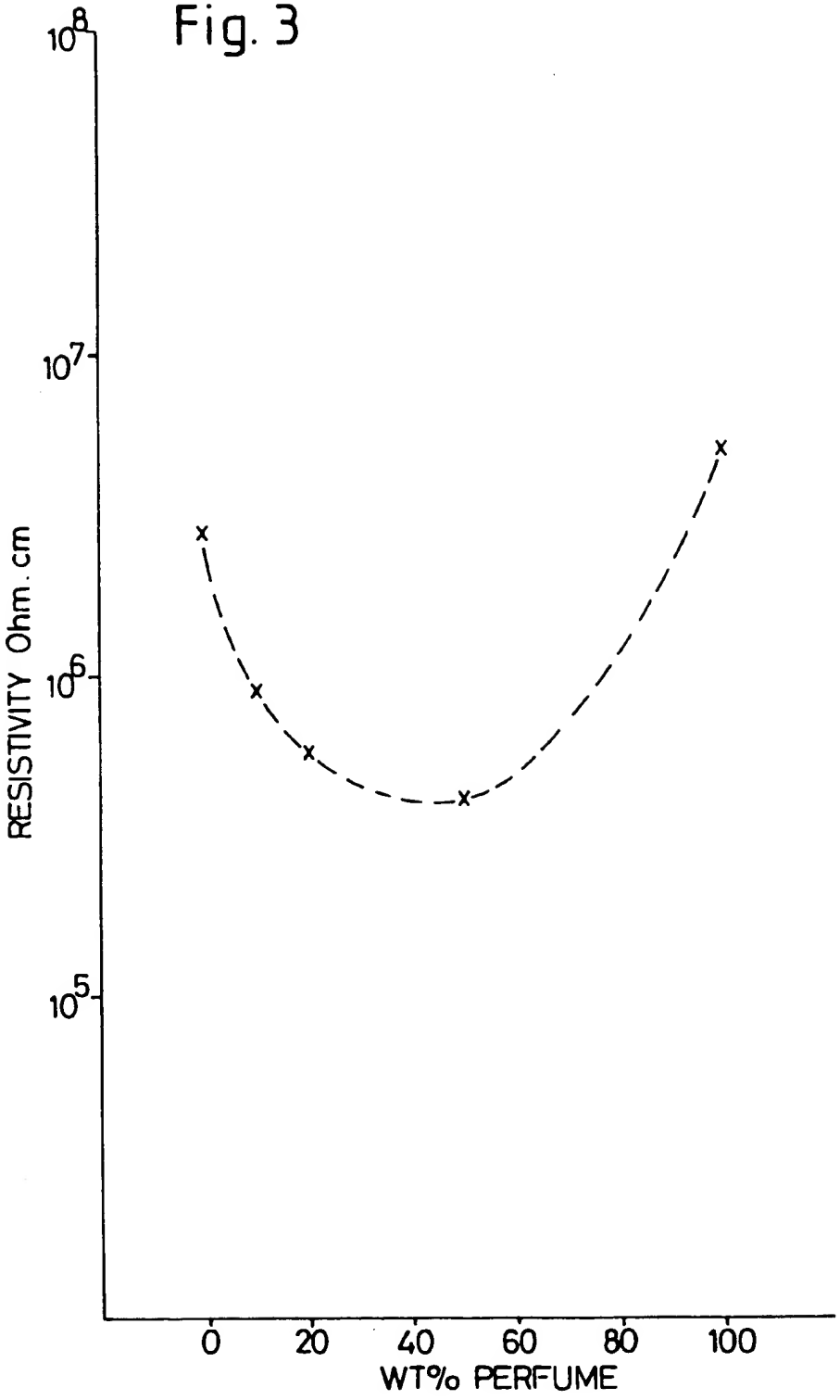


Fig. 4 Spray width data (diameter of spray with target distance 15cm)
Flow rate vs voltage

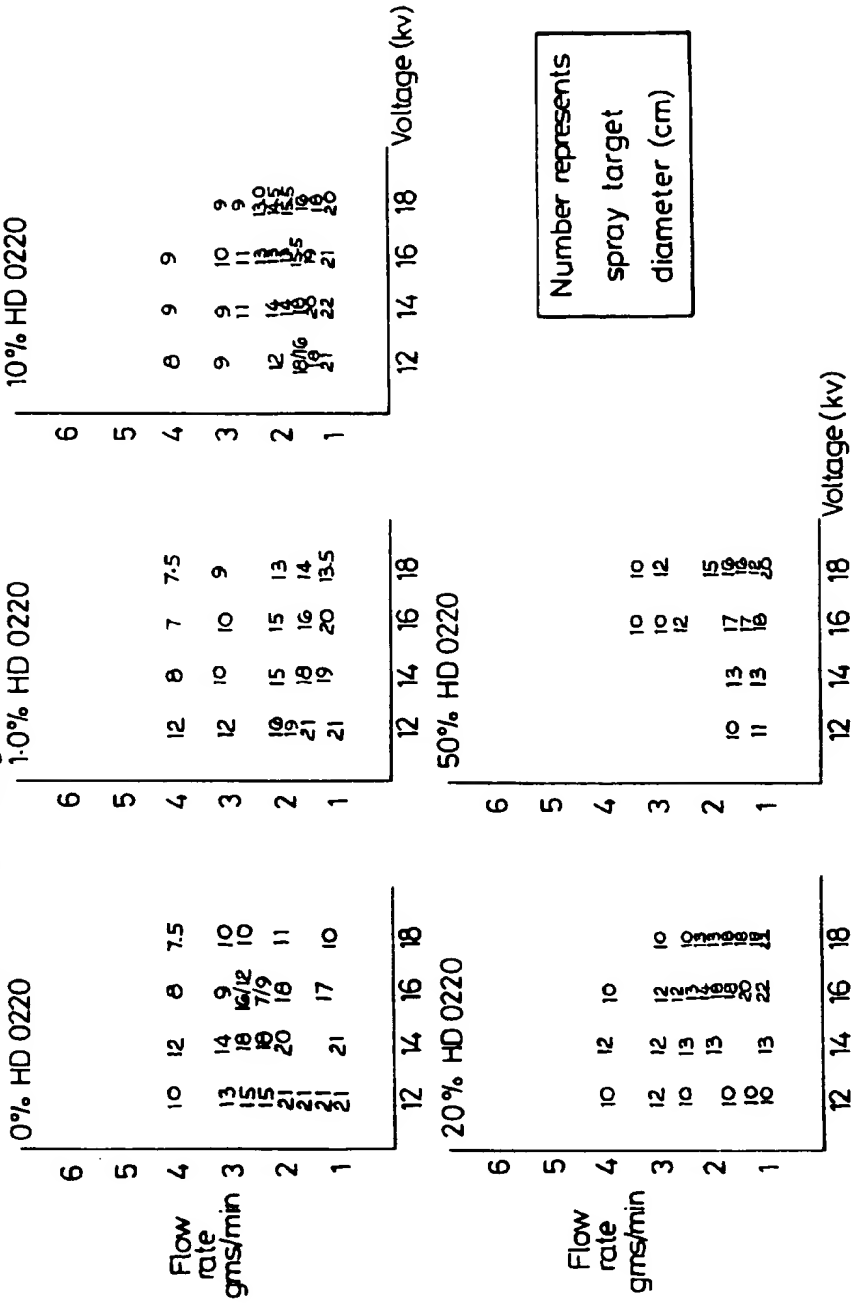
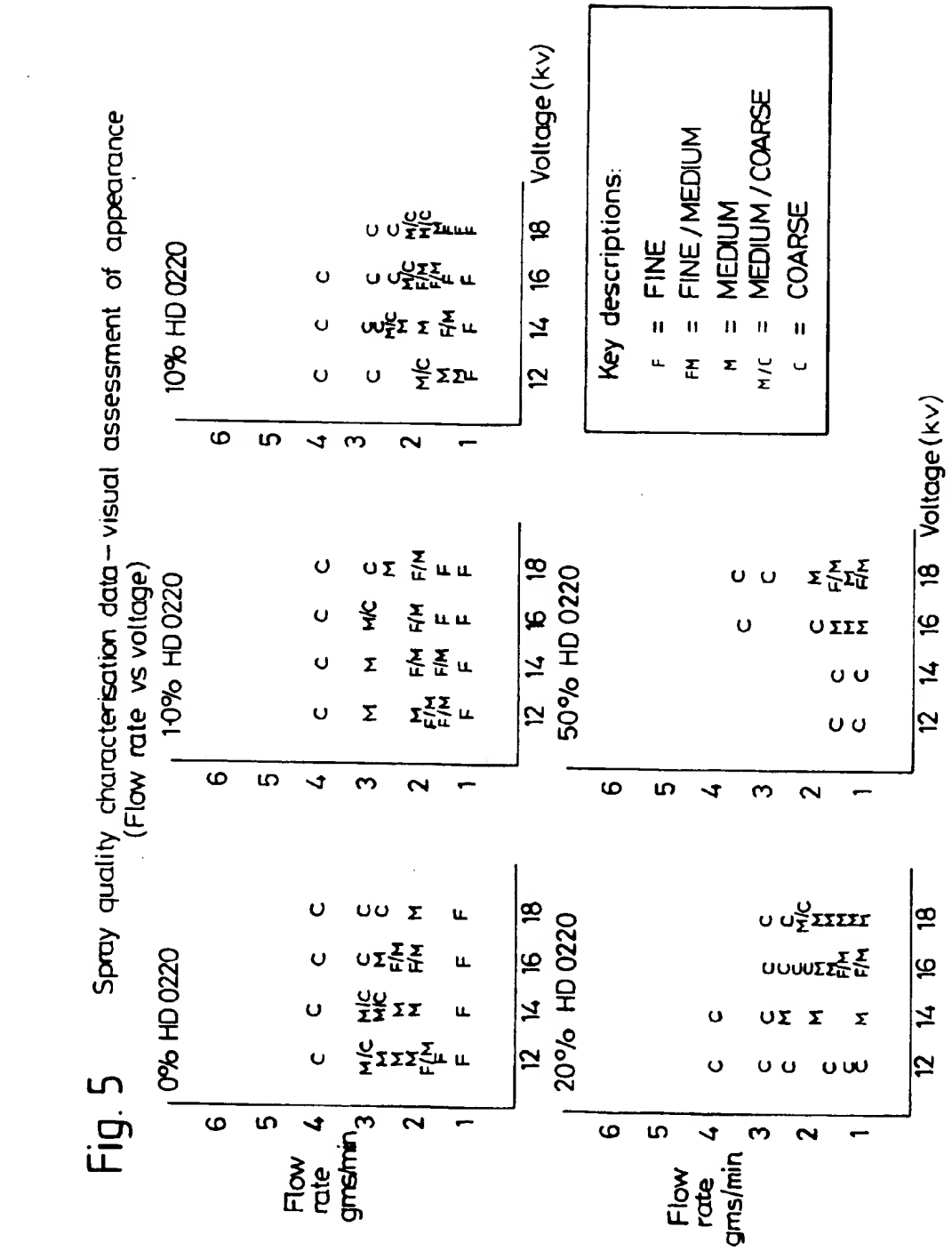


Fig. 5 Spray quality characterisation data – visual assessment of appearance (Flow rate vs voltage)



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EUROPEAN SEARCH REPORT

Application Number
EP 92 30 6449

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO-A-9 003 224 (BATTELLE MEMORIAL INSTITUTE) * the whole document *	1-3,5-8, 10-13, 15-19, 23-24	B05D1/04 A61N1/44 A61M35/00
D,A	EP-A-0 224 352 (IMPERIAL CHEMICAL INDUSTRIES PLC.) * the whole document *	1-24	
A	WO-A-9 000 446 (NATIONAL RESEARCH DEVELOPMENT CORP.) * the whole document *	1-24	
A	DE-C-730 363 (C. RONZI) * the whole document *	1-24	
A	FR-A-735 161 (G.O.E. LETOREY) * the whole document *	1-24	
A	DE-C-108 286 (J.J.STRANDER) * the whole document *	1-24	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	EP-A-0 134 951 (BAYER A.G.) * the whole document *	1-24	A61N A61M B05D
A	DATABASE WPIL Section Ch, Week 38, Derwent Publications Ltd., London, GB; Class D21, AN 81-68872D [38] & JP-A-56 097 214 (HOHYU K.K.) 5 August 1981 * abstract *	1-24	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	13 OCTOBER 1992	BROTHIER J-A.L.

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